Letting rotting sharks lie: further evidence for shark identity of the Zuiyo-maru carcass

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Another basking shark carcass washed up on the New Zealand coast reveals features that agree with the descriptions of the 1977 Zuiyo-maru catch. We also address some criticisms of material in the original article.[1]

New evidence

On December 1998 and the following January, one of us (Bev Elliott) took some photographs of a rotting carcass washed up at a beach on the Kaikoura Peninsula of New Zealand. The carcass was that of a basking shark, and was similar to another recent basking shark carcass found just south of Kaikoura.[2]

The photograph in Figure 1 is a tail view of the decomposing shark. The carcass has lost all fins, including the tail fin — what appears to be a pectoral fin is actually protruding inner organs. The carcass appears to be at a later stage of decomposition than the Zuiyo-maru carcass. One characteristic of basking sharks is the sloughed skin, giving the appearance of a mane. The 'mane' is clearly visible in Bev's picture.

The front view of the same carcass, seen in Figure 2, was photographed 6 weeks later — it had shrunk considerably from air/sun drying, and was also more weathered. The head and neck are characteristically plesiosaur-like, and together with the long body, give the impression of a 'sea serpent'. The relative size and shape of the head is remarkably similar to the head of the Zuiyo-maru carcass as it lay on deck (see Figure 3c).

The shape and number of neck (or cervical) vertebrae line up with the vertebrae in Yano's diagram (see Figure 4d). Approximately ten vertebrae can be clearly counted. These include a few back vertebrae leading inside the rib cage, which have also been exposed as a result of decomposition and weathering. This agrees with Yano's reported seven neck vertebrae, and is significantly less than

Photo by Bev Elliott

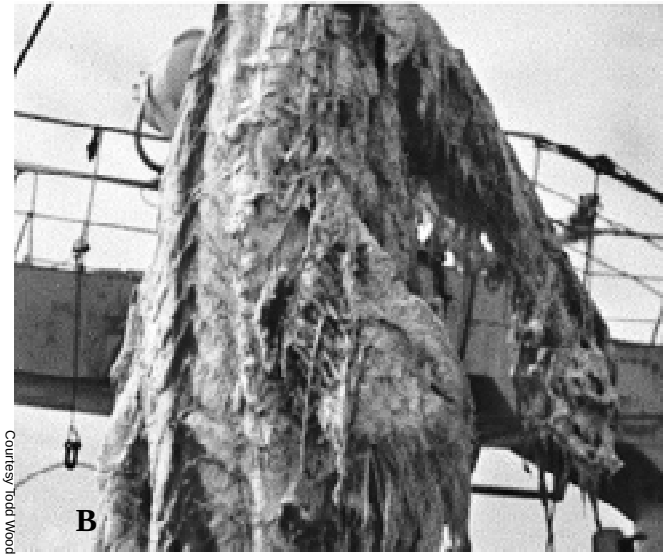
Figure 1. *Basking shark found on a beach, Kaikoura Peninsula, New Zealand on December 12, 1998.*

Photo by Bev Elliott

Figure 2*. Front view of carcass from Figure 1. Picture was taken on January 26, 1999.*

even the thirteen neck vertebrae of the short-necked pliosaurs such as *Kronosaurus*, which had much larger heads than plesiosaurs and whose body proportions were quite different from the carcass found here (see Figures 4a and 4b). And is of course much less than the plesiosaurs, which range from 28–71 vertebrae.

Courtesy Todd Wood



Courtesy Todd Wood

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Figure 3. *Photographs of carcass netted by Zuiyo-maru taken by Michihiko Yano on April 25, 1977. a) Front view of the carcass. This picture mainly inspired the plesiosaur identification. b) Rear view of carcass. c) Carcass lying on deck (from Jerlström).*[1]

The carcass vertebrae (Figure 2) are clearly short and cylindrical. Some are weathered in the centre to give an 'hour-glass' shape. The original shape is clearer in the less decomposed tail vertebrae of the Kaikoura carcass described in the previous article (Figure 5). The shape of the vertebrae seems to correspond to Michihico Yano's description, *'…the cervical vertebral centra seemed massive and quadrate …'*.[3] This is quite distinct from the vertebrae of plesiosaurs and other tetrapods which have radiating processes (Figure 4b).

The torso (Figure 2) appears to consist mainly of the spine and ribs covered by the remaining skin and fibrous tissue, as most of the muscle has rotted away. The ribs, are quite short compared to the length of the torso. This agrees with the body proportions of the Zuiyo-maru carcass described by Yano (but not with the proportion of his sketch) — 40 cm ribs and a 6 m torso. According to Hasegawa and Uyeno, *'Yano's measurement of the ribs was 40 cm, which is too short for ribs of any vertebrates other than cartilaginous ribs of sharks.'*[4]

Also, according to Yano's description, *'…each of the vertebrae [measured] 20 cm in diameter.'*[5] The diameter of the vertebrae was thus half the length of the ribs. This is also approximately the rib–vertebra proportion of the Kaikoura carcass.

Answering criticisms

Some of the evidence and conclusions presented in the original article have recently been challenged. We present here the more important criticisms which have not been addressed in the above discussion of our new evidence, and their answers.

In Yano's description of the carcass, there is no mention of a dorsal fin. Some plesiosaur supporters have indicated therefore, that the dorsal fin initially described by Omura *et al.*[6] is not a fin at all, but simply rotting tissue hanging above the left pectoral flipper (see Figures 3b and 6). In contrast, other plesiosaur supporters have suggested that this dorsal fin is actually one of a pair of upper fins, for instance. Goertzen writes:

> *'…a careful look at the Yano photos in front of the animal reveals that it had a small upper anterior fin on its LEFT SIDE, above the flipper, matching the one already observed on its right side (a symmetrical pair of upper fins). The upper anterior fin on the right side may be seen in the photo taken behind the creature, it having been thought that that was the dorsal fin of a shark that slid.'*[7]

After careful examination of several of Yano's pictures showing this region of the carcass, by several independent people and one author (Jerlström), we find no visual evidence to support the existence of such a fin. This area of the carcass, above the front left pectoral fin, appears to be simply part of the rotting torso (Figure 3a).

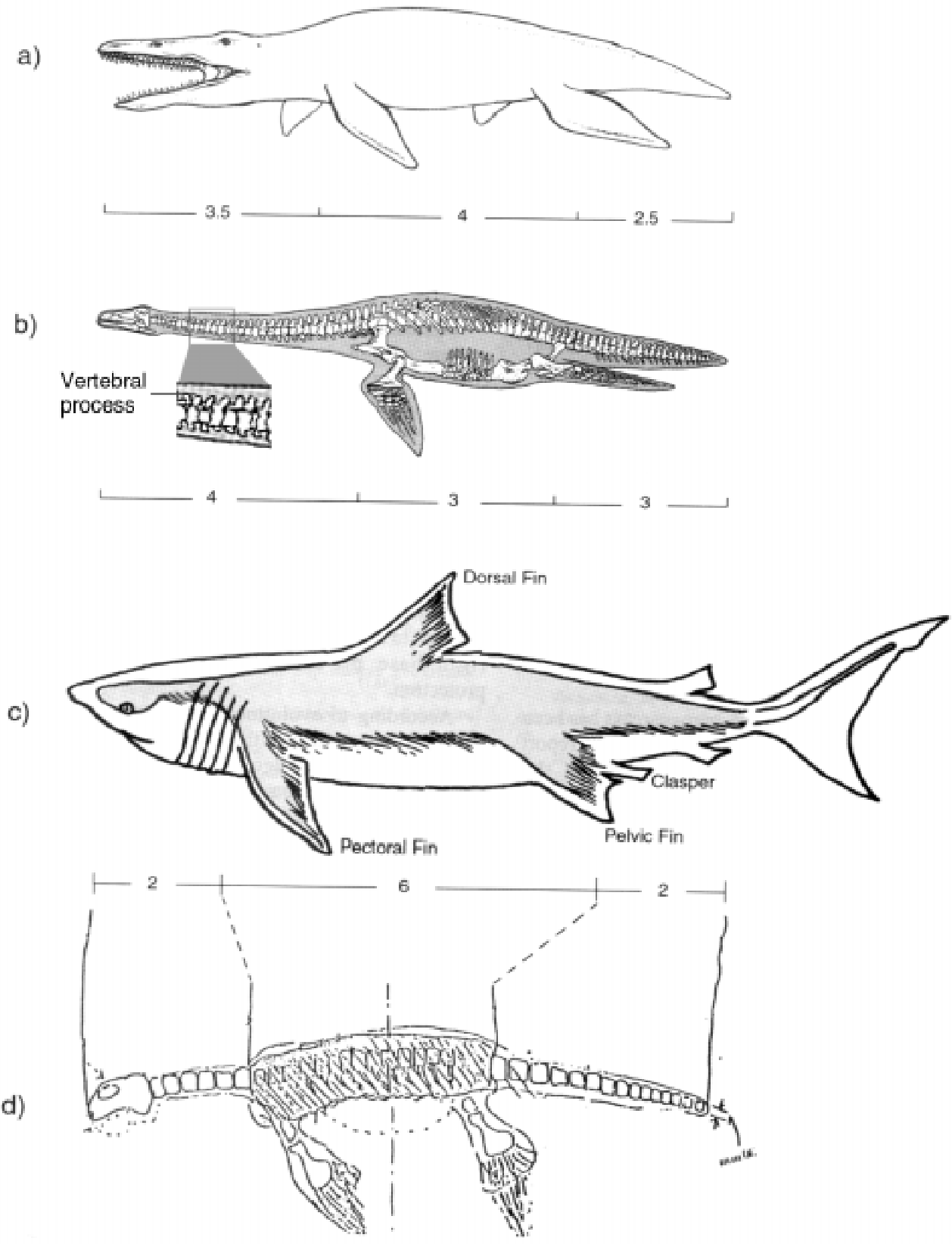

Figure 4. *Gross morphology and alignment. a) The pliosaur* Kronosaurus. *b) Reconstructed* Cryptoclidus *skeleton (a plesiosaur). c) Basking shark with inset 'pseudoplesiosaur' in grey. d) Sketch and proportions of the Zuiyo-maru carcass by Michihiko Yano (from Jerlström).*[1]

Photo by Bev Elliott

Figure 5. *Basking shark carcass found on beach south of Kaikoura, New Zealand, in August 1996. Note the lack of vetebral processes in the tail vertebrae (from Jerlström).*[1]

Another apparent piece of supporting evidence for the 'upper fin' idea is:

> *'Some ancient representations of marine tetrapods depicted the upper fin, like the Yarru sketch with Jerlström's paper …'*[7]

However, from an examination of the original painting (Figure 7) of 'Yarru' (again made by a number of independent people), it is evident that this 'upper fin' is just the matching right pectoral flipper (the rear right flipper is covered by Yarru's body). It is at the same angle to the body/spine as the left pectoral flipper and it is drawn smaller simply to convey that it lies on the other side of the body. The backbone of Yarru and the bones in the front flippers are drawn in gray (see Figure 7). The fact that these are 'flipper type' bones, which includes the phalanges at their extremities, further identifies the upper fin as the right pectoral flipper. An upper fin with flipper bone construction (and implied articulation) would indeed be an interesting proposition.

The identification by Omura *et al.*[8], of what appears to be a dorsal fin that has slipped to one side and is on its

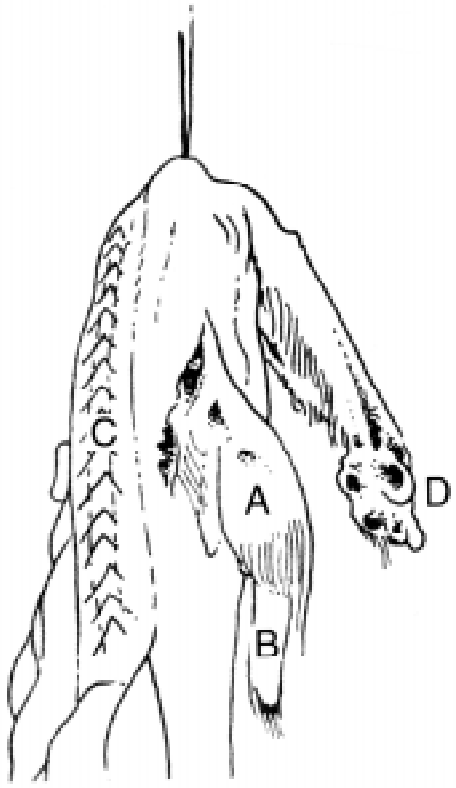

Figure 6. *Interpretative sketch of rear view of the carcass in Figure 3c. A. Dorsal fin. B. Right pectoral fin. C. Mycomata. D. Cranium. (after Omura et al).*[6]

way to detaching from the carcass, may be a common feature of the decomposition process of basking sharks. Dorsal fins may well rot quicker than the pectoral fins; this may also depend on how a carcass lies in the sea. It is interesting to note that there was no mention of a dorsal fin in the description of the 'Stronsa beast',[9] which was later confirmed to be a rotting shark. But a long neck, pectoral and pelvic fins, as well as a hairy mane were clearly identifiable.

With respect to adipocere (waxy substance produced from carcass muscle fat) formation, some have criticised the apparent inconsistency between two of the statements in the original article, i.e. *'The thick fat tissue and the reddish muscles beneath them …'* against *'basking sharks are known to have large fat deposits in their white muscles.'*[10] But like other fish, sharks have red muscle as well as white muscle, the red muscle actually predominating in slow swimming fish like basking sharks.[11] So adipocere may be from white muscle deposits close to the red muscles. Some white muscles may also appear red because of residual blood.

In order to cling to the plesiosaur/tetrapod belief, and in an attempt to ignore the strong evidence for a basking shark, some argue that plesiosaurs may also have had horny fin fibres in their flippers consisting of elastoidin, and that the carcass belongs to an as yet unidentified

living species of plesiosaur, i.e. with fewer neck vertebrae. But amino acid analysis and morphological analysis of the fibres match basking shark elastoidin. The fact that decomposing basking sharks, which match the Zuiyo-maru carcass in many details, are commonly washed up on the New Zealand coastland strengthens the case for the shark identity of the Zuiyo-maru carcass find.[12]

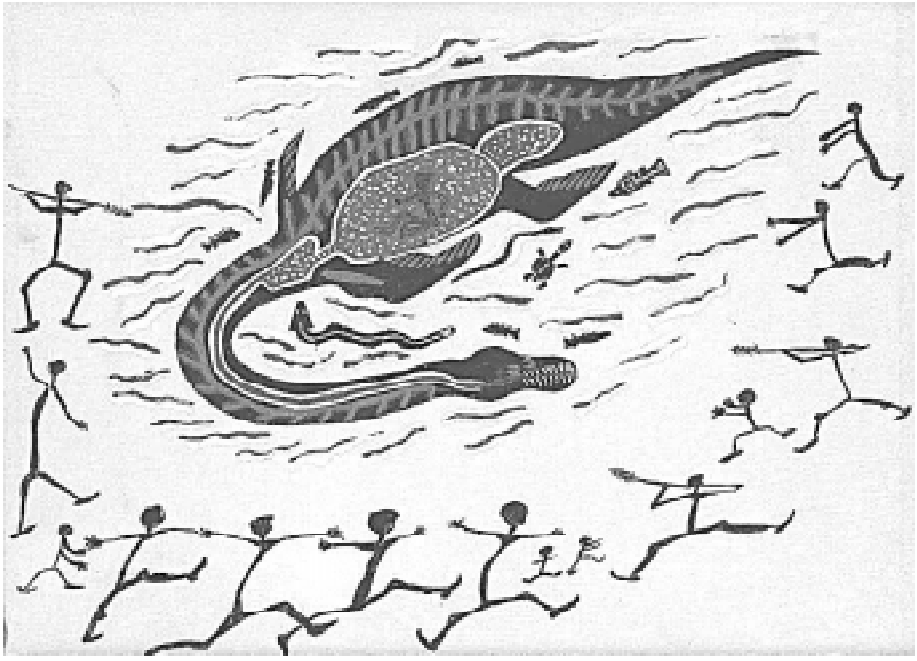

Figure 7. *Painting of the plesiosaur-like creature, 'Yarru', by the Kuku Yalanji tribespeople of far North Queensland, Australia (from Jerlström).*[1]

Conclusion

The second decomposing basking shark found on the New Zealand coast shares many features with the Zuiyo-maru carcass: the size and shape of the head, the size, shape and number of neck vertebrae, and the relative size of the ribs compared to the vertebrae.

The criticisms addressed above appear to have ignored the weight of evidence presented in the original article.[1] Although it is impossible to make a 100% watertight evaluation of any creature based solely on a few photographs, an interpretative sketch and eye witness reports of the decomposing remains, the evidence collected so far overwhelming favours the basking shark identity for the Zuiyo-maru carcass.

References

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